DOCUMENT RESUME

ED 205 798 CE 029 837

AUTHOR Crank, Ron
TITLE Transportation.
INSTITUTION Pittsburg State Univ., Kans. Kansas Vocational Curriculum and Research Center.
SPONS AGENCY Kansas State Dept. of Education, Topeka. Div. of Vocational Education.
PUB DATE Jun 81
CONTRACT 81-133-10
NOTE 20p.; For related documents see CE 029 829-838.
AVAILABLE FROM Kansas Vocational Curriculum Dissemination Center, Pittsburg State University, Pittsburg, KS 66762 ($2.00).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Behavioral Objectives; *Conservation Education; Efficiency; Energy; *Energy Conservation; *Fuel Consumption; *Fuels; Learning Activities; *Motor Vehicles; Postsecondary Education; Secondary Education; Student Developed Materials; Tests; Transparencies; *Transportation; Units of Study; Vocational Education
IDENTIFIERS *Energy Consumption

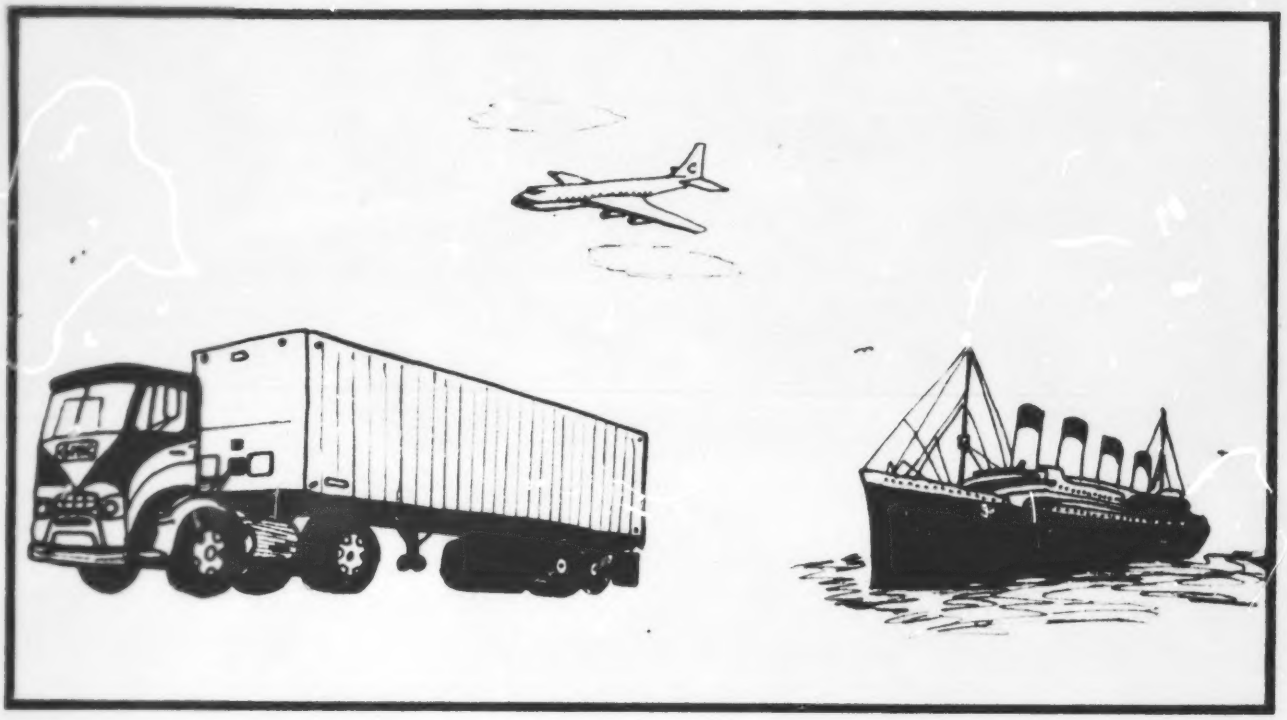
ABSTRACT

This instructional unit is one of 10 developed by students on various energy-related areas that deals specifically with transportation and energy use. Its objective is for the student to be able to discuss the implication of energy usage as it applies to the area of transportation. Some topics covered are efficiencies of various transportation modes, basic strategies to reduce energy consumption when using transportation, and methods to improve transportation efficiency by practicing changed methods of operation and maintenance of a vehicle. Material in each unit may include some or all of the following: terminal and specific objectives, list of references, information sheets with terms and definitions, informative materials, transparency masters, assignment sheet(s), and unit test with answers. (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED205798

TRANSPORTATION



by

Ron Crank

Funded by
The Vocational Education Administration Section
Kansas State Department of Education
Contract #81-133-10

Produced by
Kansas Vocational Curriculum Dissemination Center
Pittsburg State University
Pittsburg, KS
June 1981

CE029837

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

F. M. Slaper

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

TRANSPORTATION

TERMINAL OBJECTIVE

Upon completion of this unit the student will be able to discuss the implication of energy usage as it applies to the area of transportation.

SPECIFIC OBJECTIVES

After completion, the student will be able to:

1. Discuss efficiencies of various transportation modes.
2. Indentify factual statements concerning energy usage related to transportation from non-factual statements.
3. List two general functions of energy usage relating to transportation.
4. Discuss five basic strategies to reduce energy consumption when using transportation.
5. Discuss ten methods to improve transportation efficiency by practicing changed methods of operation and maintenance of vehicle.

TRANSPORTATION

INFORMATION SHEET

I. Terms and Definitions

A. Economics -- science dealing with production, distribution, and consumption of goods.

B. Intra-City -- refers to travel from city to another city.

C. Inter-City -- refers to travel within a city.

D. M.P.G. -- indicates the Miles Per Gallon rating of a particular vehicle.

E. Strategies -- an over-all plan or approach to solve a problem or find a solution.

II. References:

A. "Energy Consumption for Transportation in the U.S.", Eric Hirst, Oak Ridge National Laboratory, ORNL-NSF-EP-15.

B. Steinhart, Carol and John. Energy Sources, Use and Role in Human Affairs. North Situate, Massachusetts; Duxbury Press, 1974.

C. Fowler, Joan M. Energy and the Environment. New York; McGraw-Hill Book Company, 1975.

D. Abelson, Philip H. (edited by) Energy: Use, Conservation, and Supply. Washington, D.C.; American Association for Advancement of Science, 1974.

E. Shultis, J. Kenneth (edited by) Perspectives in Energy: 1977. Mannattan, Kansas; Kansas State University, 1977.

F. MVMA Motor Vehicle Facts and Figures. 1977.

TRANSPORTATION

The activities related to transportation consume a large percentage of the total United States energy. Close to 40% of the net energy consumed (total energy used minus amount lost in generation of electricity) is directly or indirectly used to move our nations' people and needs.

The transportation sector of energy consumption uses 25% of the energy directly. Much of this, in fact nearly all, requires oil to fuel engines that power vehicles of transportation.

There are two main functions of transportation. One to move people and the other things. When we consider transportation of both people and things we should be aware of the five basic methods:

1. Waterway
2. Pipeline
3. Rail
4. Auto or Truck
5. Air

Moving is usually based on a system of cost per ton mile when measurement of the different methods are compared. (The measurement is based on moving one ton of cargo or people a distance of one mile or multible of these amounts) Water and rail are by far the least expensive followed by pipeline and over the road vehicles. Air transportation is quite expensive but this is caused by the added dimension of speed and time factors rather than simple movement of people and goods.

The moving of people consumes approximately 60% of the energy expended in transportation. Over 90% of our people travel by automobile. Inter city traffic accounts for about 88% of private auto usage in the U.S.

Because of the intensive usage of oil to refine fuels to power people transportation, this segment of energy has been selected as a conservation target. The life style and attitudes that have been developed in the twentieth century, particularly since World War II, have increased use of the private auto for nearly all travel.

Faced with changes in supplies of traditional fuel sources for energy will mean some rethinking of attitudes and changes in basic life styles.

Some basic strategies have emerged to curb energy consumption on a personal level. They are:

1. Reduction of speed limits.
2. Increasing passengers per vehicle
3. Production of smaller, lighter automobiles.
4. Reducing the level of auto travel.
5. Economic considerations like increased prices.

The strategies relate to several basic factors that are quite important. Load or weight, engine efficiencies and the probability of causing people to switch modes of travel that could be more ton-mile efficient.

We have observed in our daily lives both public laws and economic measures that are designed to reduce consumption or lower consumption rate or remove the use altogether of scarce fuel using transportation.

The lowering of the speed limit from 70 m.p.h. to 55 m.p.h. on our highways is calculated to have saved on an average 17% to 25% of fuel

usage based on driving methods practiced by the average motorist. Increasing the average number of passengers per vehicle by car pooling is a sensible method to reduce both congestion and other vehicle related problems.

We have witnessed the production of lighter and smaller transportation during the last half of the seventies. Auto components and design are changing to produce transportation with both homogenous looks and general characteristics.

Many suggestions are given to reduce auto travel from two wheel to no-wheel to using the classified pages of the phone directory. Bicycles and motorized two wheel conveyances are appearing more abundantly each year. Some forms of two wheel cycles are so fuel efficient that a year's supply of gas is offered as an inducement to buy.

The most significant impact caused by any strategy has been the forces created by the economic tool of price. The price of scarce commodities have always been able to reduce consumption.

We see changes in where people live i.e. closer to work or school and a vast attitude change away from rural living and city work. People are encouraged to walk, many jog for health reasons, thus requiring no wheels at all and certainly no fuel of a scarce nature.

The improvement of engine efficiency is a vital factor to the continued usage of the internal combustion engine in personal transportation. This is because the typical American car engine converts gasoline to motive power with efficiency of less than 20 per cent. Some of the viable strategy discussed earlier concerning conservation would aid in this efficiency.

There exists a vast difference in the miles per gallon rate of

American cars and trucks. Requirement for small and lighter designs have increased the need for compatible weight and size power plants in contemporary vehicles.

The emergence of alternative fuels, engine types and methods of power are not well accepted but could become viable in coming years. Electric cars are dependent on the development of a proper storage battery and some change in usage patterns. Gas turbine engines have been around for some years and may only be limited in viability by the lack of mass produced numbers to make this type economically feasible.

Alternative fuels or combinations of refined oil fuels with other type of base related stocks can be found at hundreds of local service stations throughout the country. Methane gas or alcohol are quite feasible possibilities to replace traditional fuels for transportation. The South American country of Brazil has a very extensive program of alcohol powered engines in all types of conveyances.

Most recent development of a practical sense has been the use of "Gasohol". This is the commonly accepted name for a fuel mixture of gasoline and ethanol. Mixed in proportion of 90% gasoline and 10% alcohol, this blend can be burned in an internal combustion engine without modifications. Production of ethanol is made possible by the components of energy of wood or coal in the case of methanol and grains or commonly known as grain alcohol in producing ethanol.

The use of these secondary fuel sources are important in the fact that they are cleaner or as clean burning as traditional fuels. Also, these products are provided from renewable resources of grain and wood. There are resources available to produce alcohol not yet being fully used. Biomass conversion processes make use of energy sources not now being utilized.

The most significant savings that can be achieved, in the nearby future, is the action by the owners of these present vehicles. Consumers have been encouraged to acquire automobiles with high mile per gallon (mpg) ratings. However, this may not be possible or always practical in an economic sense.

There is much that can be done in the maintenance of and operation of your present transportation. Maintenance factors to consider:

Regular car tune-ups can save the average driver up to 200 gallons of gasoline a year and reduce emissions.

Replace air filters and periodically check all pollution control devices.

Check air level in your tires regularly and increase amount to to those posted on tires.

Proper allignment of wheels reduce fuel cost and lengthen tire wear.

Brake adjustment can reduce drag and improve fuel efficiency.

Proper viscosity oils usually low in cold and higher in warm weather. Consider using super oils that increase fuel economy.

Always use proper octane rated fuel recommended for your car -- just high enough to prevent knocking.

Use caution when filling tank. Don't overfill and cause spillage, a gross loss of energy.

These measures are important in reducing friction among others and also prolong the life of your car's engine.

Engine overwork at higher speeds along with increase wind resistance are factors to consider in better driving operation.

Practices that can be cost efficient are:

Drive at moderate speeds appropriate for your location.

Use a smooth steady pace on the accelerator so you flow smoothly through traffic.

Avoid braking and keep at proper distances from cars in front to avoid stopping or braking.

Use the air conditioner sparingly and keep air vents open and windows closed.

Don't leave engine idling longer than a couple of minutes. One minute requires as much gas as restarting engine.

Watch the weight and don't carry unnecessary items or heavy loads.

Drive slowly at a moderate speed to warm engine instead of a long idle period.

The dramatic effects of speed change alone are illustrated in the following figures from government fuel test on various autos by weight. This does not take into consideration air resistance, weight distribution or the efficiency of power plants but indicates what loss of efficiency there may be in a typical vehicle.

EFFECT OF SPEED ON FUEL CONSUMPTION RATES

IN SELECTED WEIGHT AUTOMOBILES

Car #	Weight (Pounds)	Speed/MPG 30	40	50	60	70	Chg % 50/70 MPH
1	2300	21.5	20.1	19.1	17.8	16.7	12.5%
2	2400	18.2	20.0	16.3	15.7	13.6	16.6%
3	3500	21.3	21.3	18.9	17.3	15.3	10.1%
4	4000	22.5	21.9	22.2	21.8	17.2	22.5%
5	4500	20.3	20.0	17.5	16.7	14.8	15.4%
6	4900	17.1	17.2	16.1	14.9	13.1	18.6%
7	5200	18.3	19.3	15.6	14.2	12.7	18.5%

This comparison could be made by comparing the weight of your own vehicles and your friends to see just how weight efficient you would find different cars at varying speeds. This information appears to support the conservation aspects of speed reduction on our highways. Comparisons

of 50 mph to 70 mph range from 10% up to 22.5% more cost in fuel efficiency to use the higher speed.

The additional savings caused by maintenance and operations can increase by new habits like:

Share the ride.
Combine trips.
Eliminate unnecessary trips.
Use alternatives-walk, bicycle.
Plan vehicle use better.
Keep records of expenditures, costs.

The savings that this overall activity may produce is best realized in the following cost reduction comparison. Consider the cost of gasoline at $1.20 per gallon.

VEHICLE OPERATION SAVING POTENTIAL

Efficient Handling	Warm engine properly. Use moderate speeds. Anticipate traffic properly. Move smoothly through traffic.	6¢
Planning	Share ride to work	10¢
	Plan family errands. Combine trips. Use telephone and mail. Ride with others.	4¢
	Plan social and recreational trips. Combined trips	4¢
	Share rides.	4¢
Car Care	Proper Tire Inflation	5¢
	High mileage oil	3¢
	Tune-ups and adjustments	5¢
Car Choices	Buy radial tires	3¢
	Replace car (when change means 15mpg increase) . .	25¢
	Potential Savings	69¢

Potential savings of nearly 50¢ a gallon can and should not be ignored.

For those who choose not to use a personal vehicle for one reason or another, the alternatives are not without expecting some lack of ease and comfort.

Many types and sizes of personal units of transportation have become popular during the period of higher fuel prices. Motor bikes, minibikes and different horsepower motorcycles are now quite common. The use of two wheeled vehicles of some or higher amounts of power require different habits than normal driving. Maintenance and safety factors are more critical. The use of personal transportation saves considerably on gas economy.

The use of mass transit transportation is a very good alternative to high fuel prices and scarce energy. Public transportation has changed because of under usage. The dramatic decline in mass transit since the end of the second world war caused many urban areas to remove facilities, tracks and lines used to support the systems. A reduction in mass transit use from 31% in 1950 to less than 13% today is not a viable answer to conservation needs. Cost to install the modern systems will delay the contribution of this source to energy savings.

The use of airlines is our least effective mode of transportation in relation to energy efficiency. The lack of efficiency is attributed to increase speed and convenience obtained. The less use of air transportation may be a life style change we will have to accept like other conservation practices.

Transportation of goods are accomplished by our system of major super highways using over the road trucks. Some may consider the super highway system as a subsidy to the trucking segment of transportation.

We should keep in mind that the type of goods or freight determines the choice of mode of transportation.

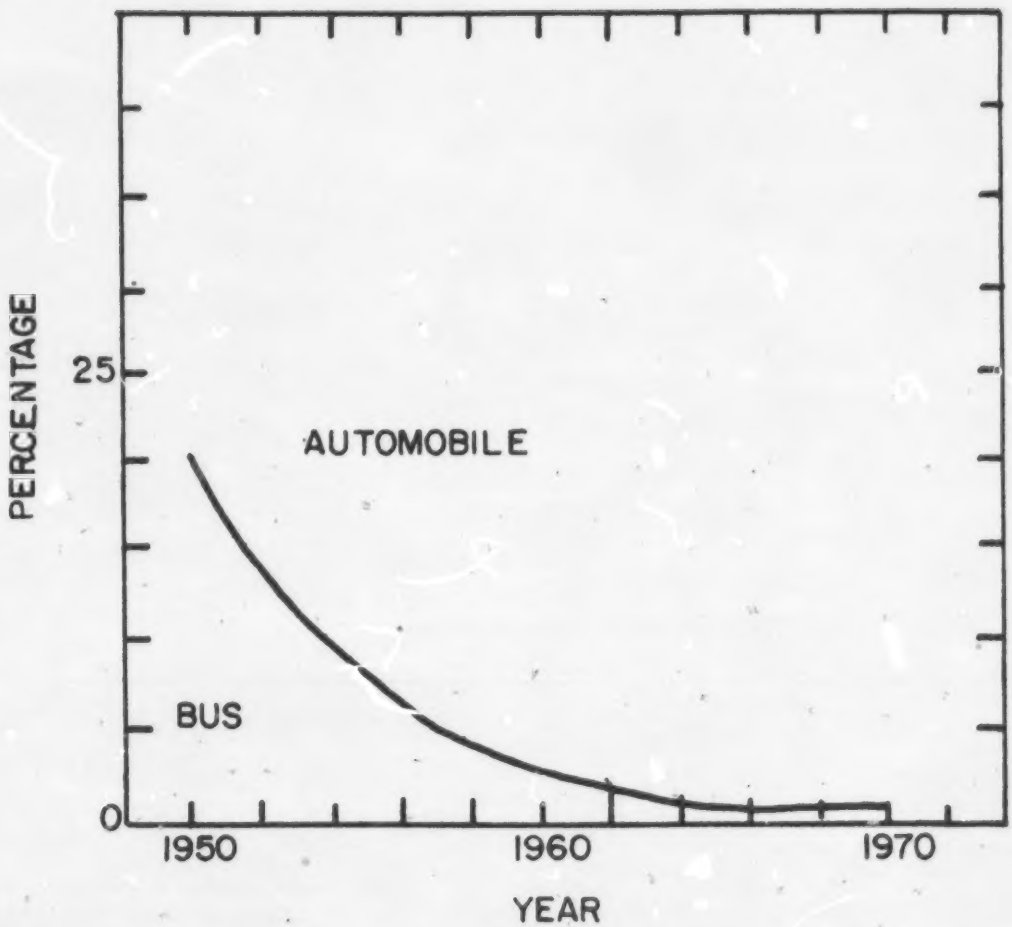
Many areas of our nation are not served by railroads due to economic or agriculture production reasons. Pipelines, however cost efficient, are suitable only to a limited kind of energy delivery market. The truck can be very efficient when used to carry freight in conjunction with other types of conveyances for some of the trip distance like piggyback haul railcars or loaded on barges. Freight that is crated or containerized to be shifted from one form of conveyance to another based on energy is very desirable.

In conclusion, the future will contain many changes in our mode and uses of transportation. We will see more planning and thought involved in energy usage for moving people and things. Our life styles will change but new technology will ease our transition. Automobiles will be lighter, get more MPG and have advanced control and monitoring devices to ease fuel consumption. Car design will cause less drag, engines will evolve that use energy at a better conversion rate.

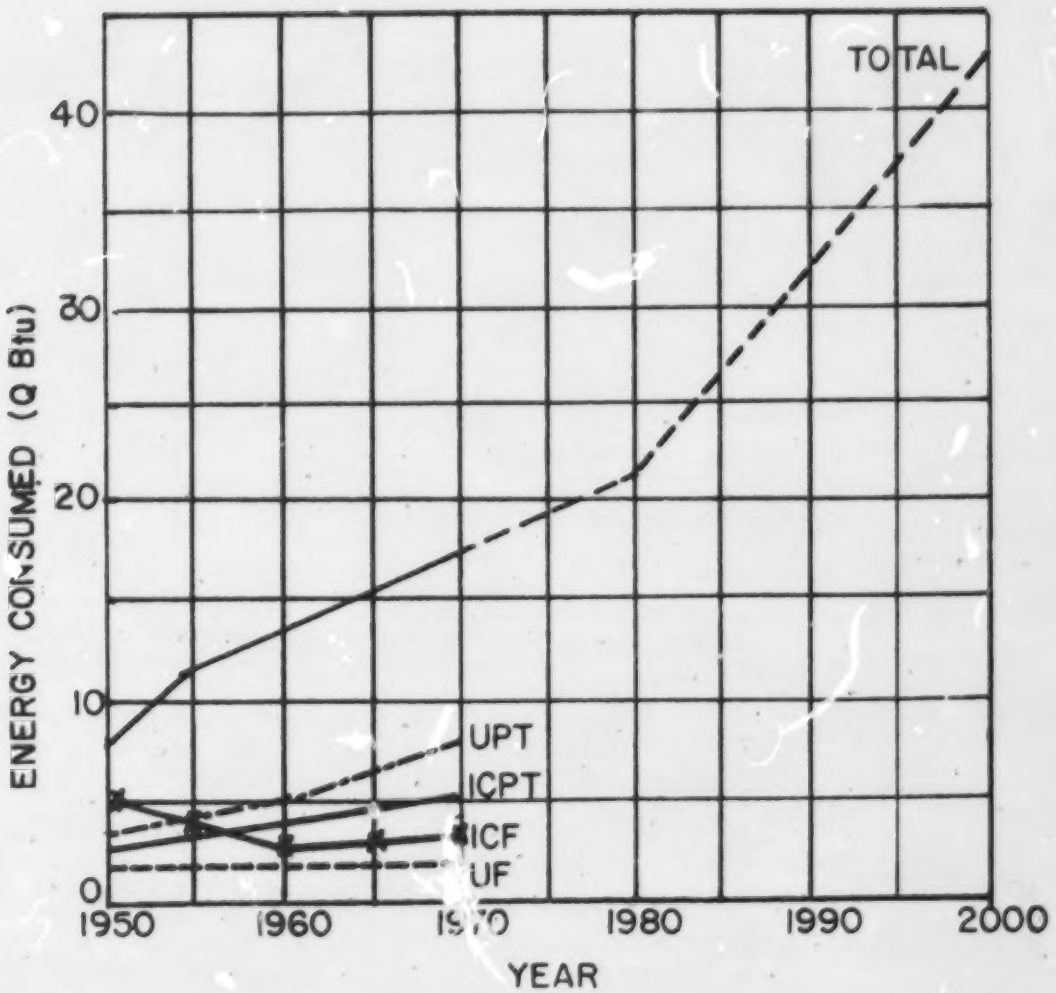
Transportation of goods will be accomplished in the future with more emphasis on what energy costs are required. The speed or convenience we have grown to expect will not be as possible. New innovations like electronic information transfer or electronic mail reduce the shipping and mailing cost problems. Better planning, more complete inventories of all personal and industrial goods will be required.

Our future in moving things seems to be focused on rethinking our priorities, changing our attitudes, and utilization of exciting new technologies.

INTER AND INTRA - CITY TRANSPORT



INTER AND INTRA - CITY TRANSPORT



ENERGY DATA FOR PASSENGER TRAFFIC
1970

Inter-City

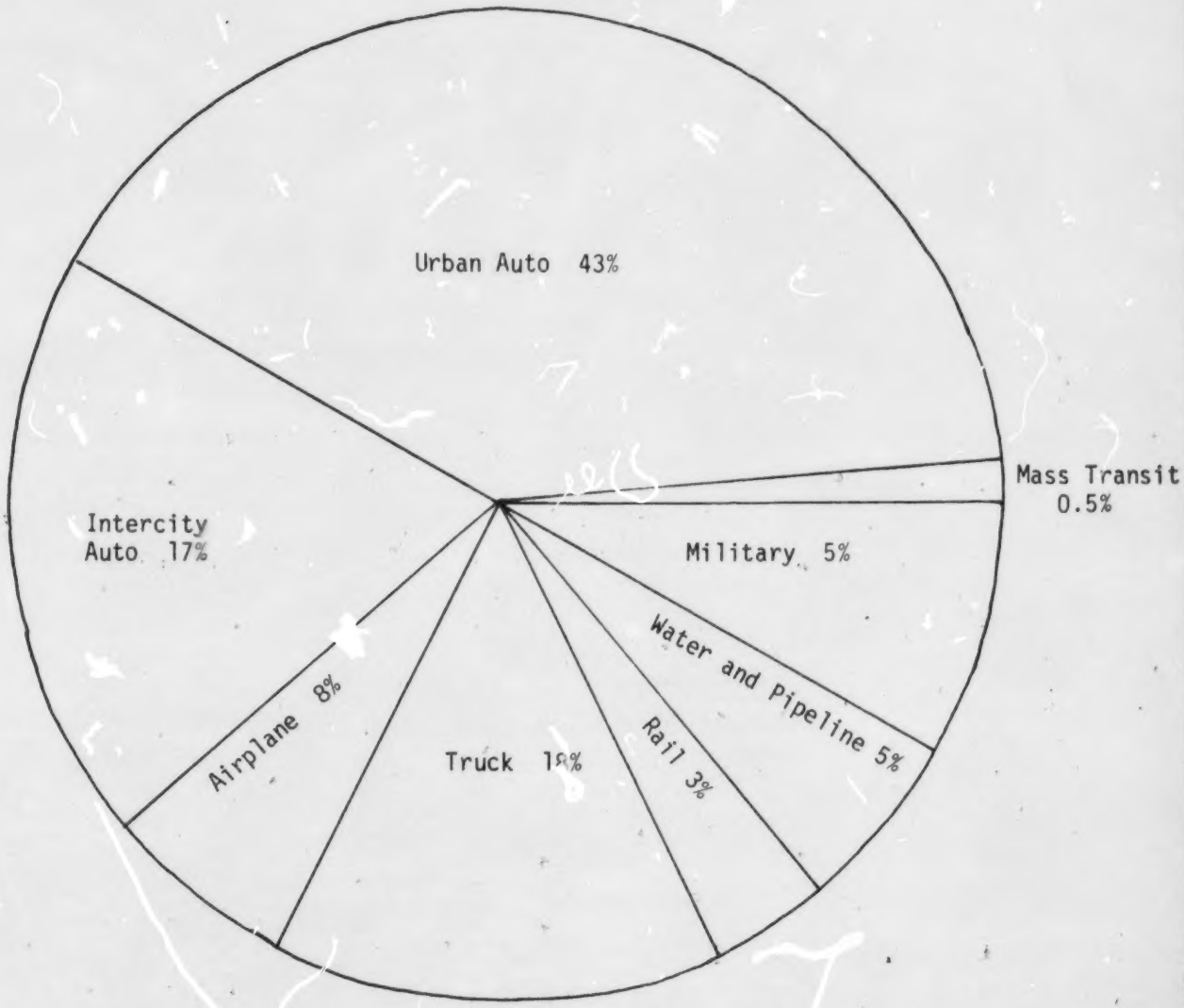
Mode	Average Passenger Capacity	Average Load Factor	Energy Cost (BTU per passenger mile)
Railroad	69/car	35%	2,900
Bus	41	45%	1,600
Automobile	5	48%	3,500
Airplane	106	50%	8,400

Urban

Mode	Average Passenger Capacity	Average Load Factor	Energy Cost (BTU per passenger mile)
Bicycle	1	100%	200
Walking	--	--	300
Rail (Trolleys, Subways)	?	?	2,300
Bus	55	20%	3,800
Automobile	5	28%	8,500

DISTRIBUTION OF TRANSPORTATION

FUEL USES 1978



TRANSPORTATION

TEST

I. True - False. Indicate the correct response in the statements below by circling "T" for true and "F" for false.

T F 1. Approximately 20 percent of the net energy expenditure of the United States is related to transportation activities.

T F 2. Moving of people utilizes approximately 60 percent of energy expended in transportation.

T F 3. Most passenger miles are travelled by private automobile.

T F 4. Reduction of speed limits while driving has little effect upon the efficiency of the internal combustion engine.

T F 5. One of the first effects of recognition of an energy shortage was an increase in the purchase of compact cars.

T F 6. Efficiency ratings of typical American car engines is less than 20 percent.

T F 7. It is possible to operate automobiles on such products as methane and alcohol.

T F 8. Superhighways built at public expense are considered an indirect subsidy to the trucking industry.

T F 9. Most efficient mode of transportation is the airline industry.

T F 10. Automotive options such as air conditioners and pollution control devices contribute significantly to lack of efficiency of automobiles.

T F 11. One of the major problems related to electric automobiles is that of increased air pollution.

T F 12. One major advantage of an electric automobile is that of cost of operation.

T F 13. There has been a dramatic decline in the use of mass transit in recent years.

T F 14. Gasoline powered automobiles are more efficient than electric automobiles.

T F 15. Decreasing size of engine of automobiles contributes to increase in energy conservation.

II. 16. Two general functions of society that are related to use of energy in transportation were discussed in this unit. What are they?

A.

B.

17. Several strategies have been considered to cut down on energy consumption due to transportation factors. What are four of those considered effective?

A.

B.

C.

D.

18. The methods available to reduce the possible consumption of gasoline in internal combustion engine modes of travel are numerous. List at least six ways to save this fuel in both maintenance and better operation.

Maintenance
1.

2.

3.

4.

5.

6.

Operation
1.

2.

3.

4.

5.

6.

TRANSPORTATION

TEST ANSWERS

I. True - False

1.	F	9.	F
2.	T	10.	T
3.	T	11.	F
4.	F	12.	T
5.	T	13.	T
6.	T	14.	F
7.	T	15.	T
8.	T		

II. 16. General functions of transportation

A. To move people.

B. To move things.

17. Transportation related strategies to reduce energy consumption include:

A. Reduction of speed limits.

B. Economics

C. Increasing number of passengers per vehicles - car pooling.

D. Production of smaller automobiles.

18. Maintenance Practices:

1. Tire pressure
2. Allignment
3. Brake adjustment
4. Filter change
5. Proper oil viscosity
6. Weight
7. Tune-up
8. Proper octaine

Operational Practices:

1. Moderate speeds
2. Smooth pace
3. Anticipate traffic
4. Reduce idle time
5. Windows closed
6. Car pools
7. Drive records
8. Minimum braking
9. Use vehicle momentum